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Phosphate fertilizers and cereal/legume rotation improve crop yield and total microbial community diversity in soil of Western Kenya

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Cereal- legume rotation has been promoted as a strategy to increase crop yields in subsistence farms of sub Saharan Africa, and is believed to promote changes in the rhizosphere that enhance early plant growth. This study investigates the effect of cereal-legume rotation (maize (Mz) – soybean (SB); common bean (CB)-SB-Mz; SB-Mz) in combination with different rates and types of phosphate (P) fertilizers: Minjingu phosphate rock (MPR) and Triple super phosphate (TSP) on crop yields and total microbial diversity in a Kenyan Ferralsol. Soil sampling for analysis of microbial diversity was done in the third season of rotation, at three weeks after crop emergence. The microbial communities from the rhizospheric soil were generated using denaturing gradient gel electrophoresis (DGGE). Shannon Weaver index of diversity was used to determine the microbial diversity. Results showed significant increases in crop yields with a significant interaction ($P \leq 0.05$) between fertil!

izer addition and rotation regime during the three seasons. The highest maize yields were realized following a CB-SB-Mz rotation with a 150% increase (3t /ha above the control), in plots with 50 kg P/ha MPR, while Mz-CB and SB-Mz rotation had similar maize yields regardless of the fertilizer applied. Crop rotation and application of P fertilizers had a highly significant interaction ($P=0.001$) and a positive impact on both total bacterial and fungal community. Significant increases in total community bacteria were noted in Mz-CB rotation system (1.48), followed by the SB-Mz (1.44) and CB-SB-Mz systems (1.42), while the total fungal diversity was significantly lower in the Mz-CB rotation (0.93), but higher in the SB-Mz system (1.12). Overall interactions between crop rotation and P fertilizers affected the total diversity of bacterial and fungal communities in the bulk soil but crop rotation was more important in determining the total microbial diversity than the fertilizers!

. There seems to be no significant correlation between the crop yields and the total microbial diversity, probably because soil sampling was done earlier in the season. Further work is required to monitor the changes of the total community structure within and at the end of the cropping season

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